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Tectonic and Talus Caves at Pilchers Mountain, New South Wales

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Abstract

There are fourteen known caves within the Pilchers Mountain Environmental Protection Reserve, in New South Wales, Australia. The reserve contains five main chasms which run generally East-West for approximately one kilometre, over a total width of half a kilometre.

The chasms and caves were formed by massive sandstone block separation along sub-parallel joint planes. Movement of the blocks toward the valley floor was aided by the dip of the sandstone layers and presence of underlying shale bands which acted as slip planes when lubricated by groundwater. There are two distinct types of caves at Pilchers Mountain, "tectonic" caves formed by the movement of large blocks of bedrock, and "talus" caves amongst large breakdown rocks and boulders. The chasms provide a micro-climate which supports a pocket of dense, high canopy, subtropical rainforest, and the caves are home to populations of bats and other fauna.

The European history of Pilchers Mountain is detailed in chronological order from the early 1800s to the present day. A Plan of Management is in the process of being formulated by stakeholders and interested parties to ensure the continued preservation of the reserve.

Keywords: Pseudokarst, Tectonic Caves, Talus caves, Fissure caves, History, Management, New South Wales.

INTRODUCTION

Location and Access

The Pilchers Mountain caves and associated chasms are located 54 kilometres north of Newcastle, and approximately six kilometres north of Wallarobba. This small settlement is centred around a railway station and road crossing midway between Paterson and Dungog in the Hunter Valley, NSW (Figure 1). These natural phenomena are protected within a Crown Reserve which was gazetted in 1889. In more recent times the reserve has been changed to an Environmental Protection Reserve (Figure 2). Since there is no formed road to the reserve and it is completely surrounded by private property, the chasms and caves have remained almost undisturbed since their discovery. The reserve is within the elevation range of 240 to 360 metres ASL.

Access is through several private properties and permission is required from the surrounding land owners and Dungog Council before entering the Crown Reserve. For further details on access conditions etc, contact the Newcastle and Hunter Valley Speleological Society Inc. P.O. Box 15, Broadmeadow, N.S.W. 2292, Australia.

Geology

Pilchers Mountain consists of thickly bedded sandstone with lenses of conglomerate, part of the Carboniferous Wallaringa Formation (Allen, 1972). The sediments are generally yellow-brown, grading to reddish at the top of the formation (beneath a bed of Volcanics). They are mostly massive and resistant to weathering and therefore form excellent cliffs. The movement of massive sandstone blocks to form the chasms was aided by the underlying shale bands, which acted as slip planes when lubricated by groundwater (England, 1982).

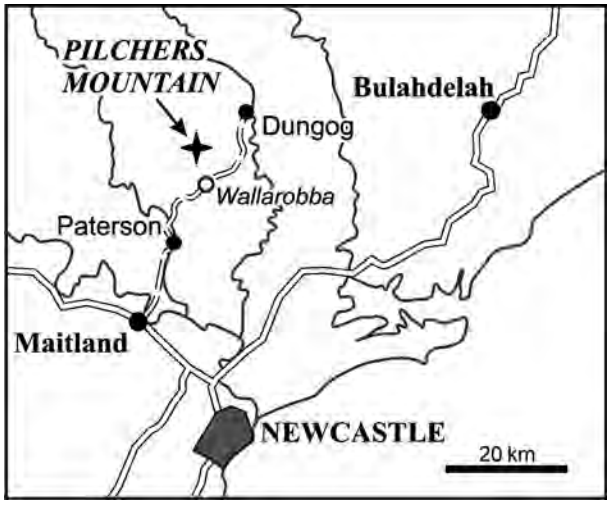


Figure 1: Location of Pilchers Mountain.

Localized dissolution of minor calcite cement in the sediments has resulted in the formation of isolated poor quality calcite speleothems in parts of Bat Cave.

Also of interest is the narrow seam of coal and shale exposed just above floor level in the main chamber of Bat Cave. The coal seam reaches a maximum thickness of around 100mm and tapers down to just a few millimetres in other places.

Hydrology

There are two permanent springs fed by groundwater in the sandstone of the chasm area. The eastern spring drains into Spring Gully Creek and the other spring runs into an unnamed creek toward the western end of the chasms. Both these creeks merge and flow into Wallarobba Creek.

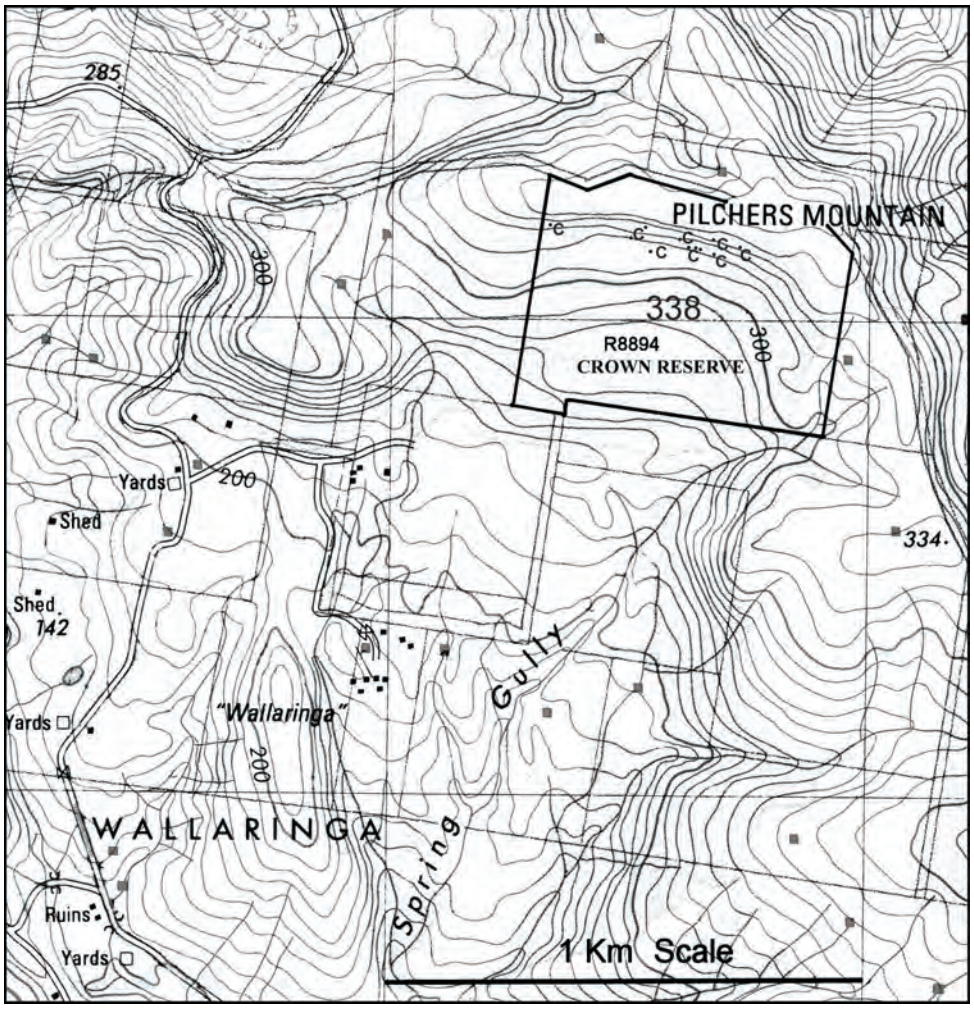


Figure 2:
Topography at Pilchers Mountain Reserve (R8894).
Enlarged from GRESFORD, 1:25000 Topographic Map
CMA 9233-3-S,
c. = caves

THE CAVES, FISSURES and CHASMS

The Pilchers Mountain Crown Reserve was established to protect the caves and unique geomorphology of the surrounding area, comprising several sub-parallel offset chasms that host a picturesque pocket of dense subtropical rainforest. The protected area lies in stark contrast to the surrounding grassy hills cleared of their original dry sclerophyll forest cover for grazing.

There are five main chasms, and a number of smaller ones running generally East -West for approximately one kilometre, over a total width of half a kilometre. The base and sides of the wider chasms are mostly strewn with massive angular sandstone blocks. The large depressions created a micro-climate which aided growth of the present pocket of subtropical rainforest.

The open chasms reach a depth of 90 metres and typically have vertical walls, with the gaps ranging from a metre or less to over 50 metres (Figures 4 & 5). There are many good examples where opposite sides of the chasms can be identified as matching the shape of separated walls. In places where the chasms are narrow, large blocks wedged between the two walls have created several large caves. (eg. Bat Cave and Rebel Cave). Smaller caves are located in piles of large angular boulders which have fallen into the wider chasms as the sandstone masses moved down-slope (eg. Valentine and Lambton Caves.).

The most northern chasm contains the Rebel Cave and Bat Cave (also known as Wallaringa, Pilchers or Main Cave). Another contains the Lambton, Valentine, Diamond Mine and other caves. In all there are about 14 known caves. The largest chamber is found in Bat Cave (22m long x 2.7m wide x 12m high) which has a survey passage length of 93m. The deepest known cave is Rebel Cave (Figure 3) with a vertical depth of 46m and survey length of 99.5m. It contains a 6m pitch (Figure 6) and another 27.5m free hang. The Bat and Rebel Caves generally follow the line of the northern chasm, while the others are more irregular as they occur in large rockpiles.

There are no reported cases of "foul air" (eg. elevated carbon dioxide concentration) being encountered in Pilchers Mountain caves despite the ingress of organic material around entrances and minimal air flow at the bottom of the deeper caves. The Rebel and Bat Caves stay damp and humid even through the worst droughts. However, the rockpile caves, such as Valentine and Lambton Caves, become dusty during extended periods without rain.

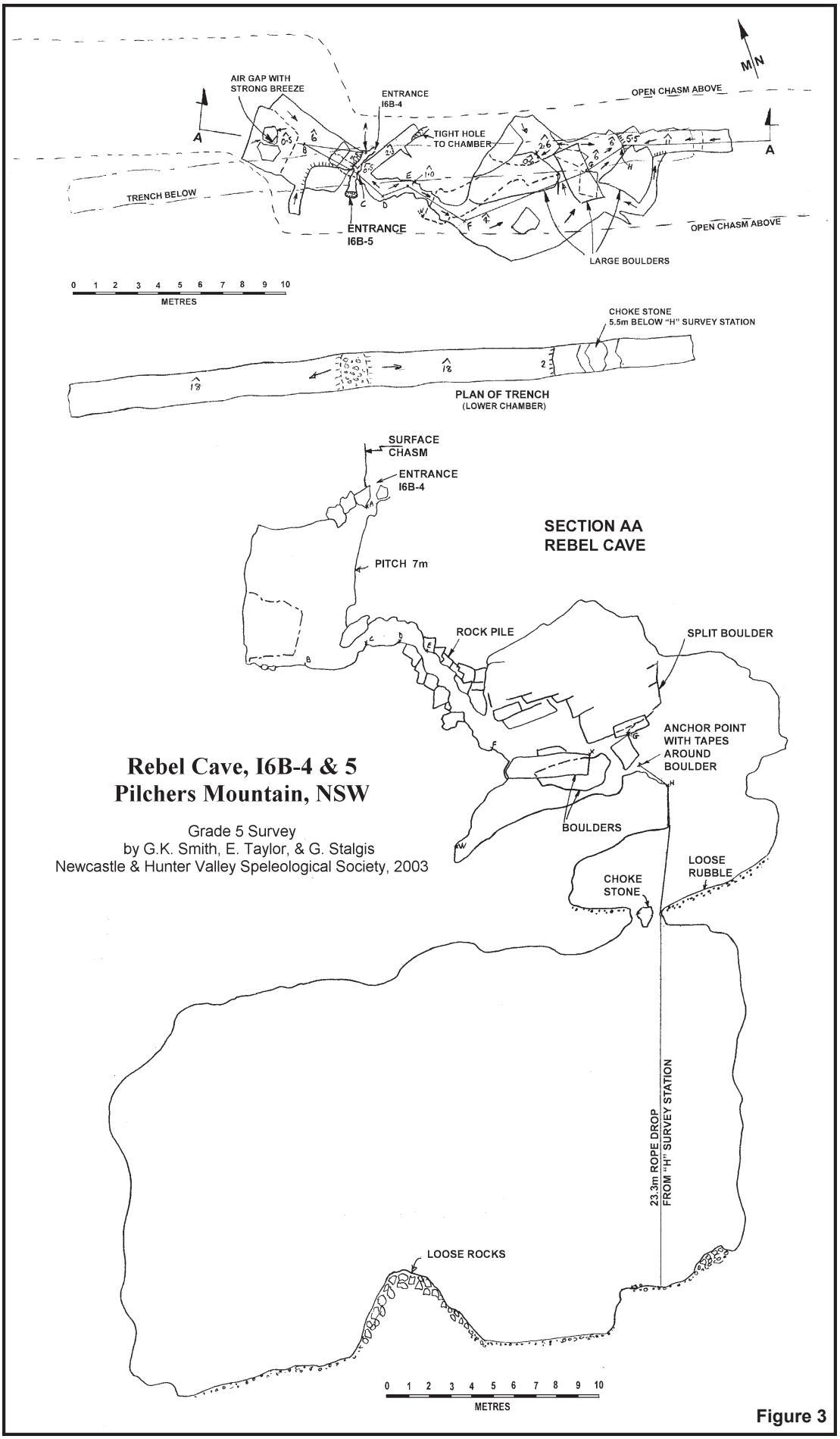

AIR GAP WITH STRONG BREEZE
ENTRANCE I6B-4
TIGHT HOLE TO CHAMBER
OPEN CHASM ABOVE
TRENCH BELOW
ENTRANCE I6B-5
LARGE BOULDERS
OPEN CHASM ABOVE
METRES
CHOKE STONE 5.5m BELOW "H" SURVEY STATION
PLAN OF TRENCH (LOWER CHAMBER)
SURFACE CHASM
ENTRANCE I6B-4
SECTION AA
REBEL CAVE
PITCH 7m
ROCK PILE
SPLIT BOULDER
ANCHOR POINT WITH TAPES AROUND BOULDER
BOULDERS
LOOSE RUBBLE
CHOKE STONE
23.3m ROPE DROP FROM "H" SURVEY STATION
LOOSE ROCKS
METRES
Rebel Cave, I6B-4 & 5
Pilchers Mountain, NSW
Grade 5 Survey
by G.K. Smith, E. Taylor, & G. Stalgis
Newcastle & Hunter Valley Speleological Society, 2003

Figure 3

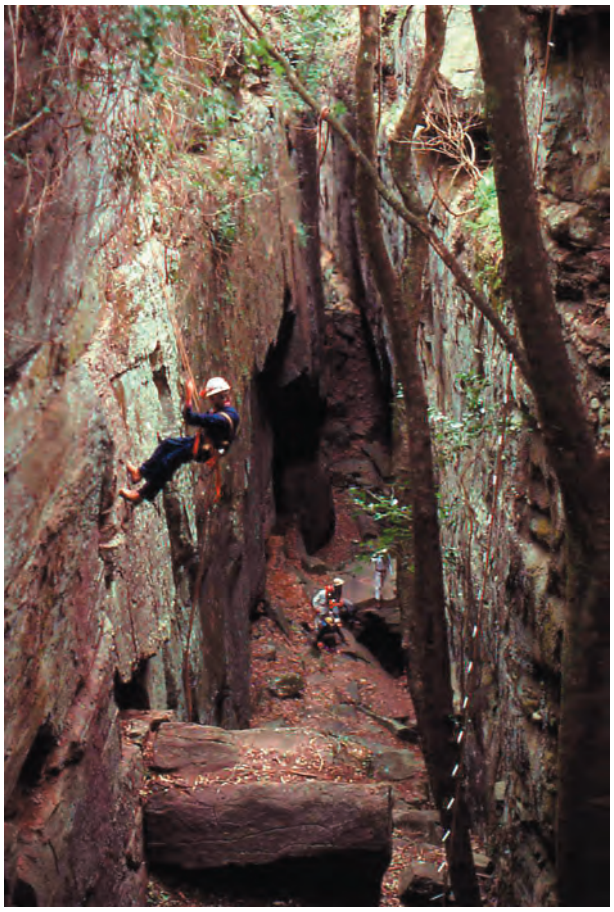


Figure 4: Northern Chasm at Pilchers Mountain

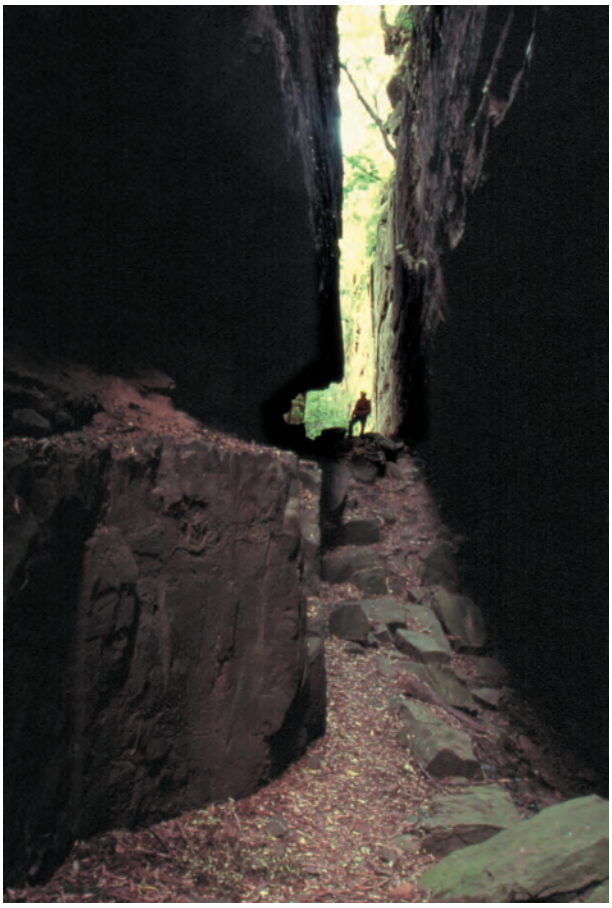
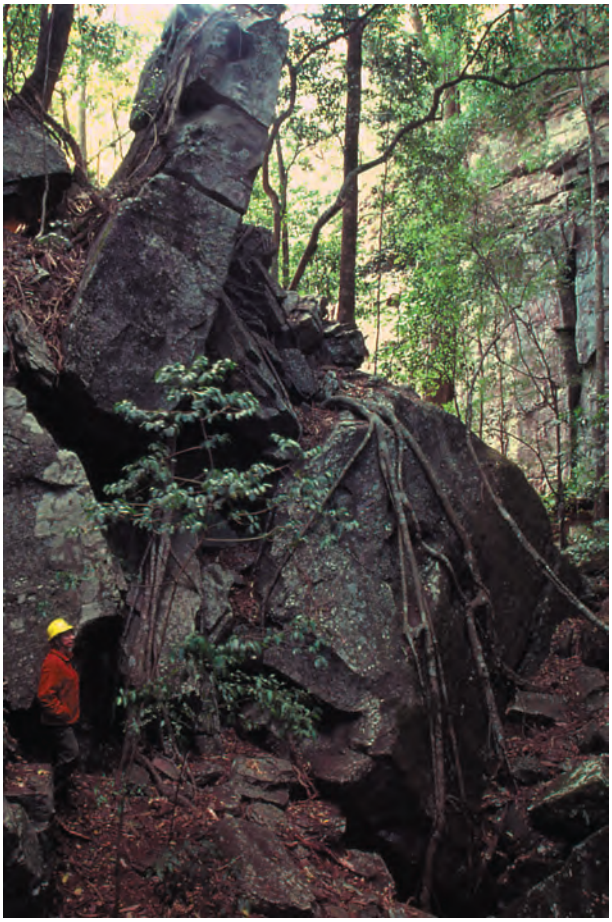


Figure 5: Base of Northern Chasm

Figure 6: Chockstones in upper pitch, Rebel Cave

Figure 7: Surface rubble and vegetation



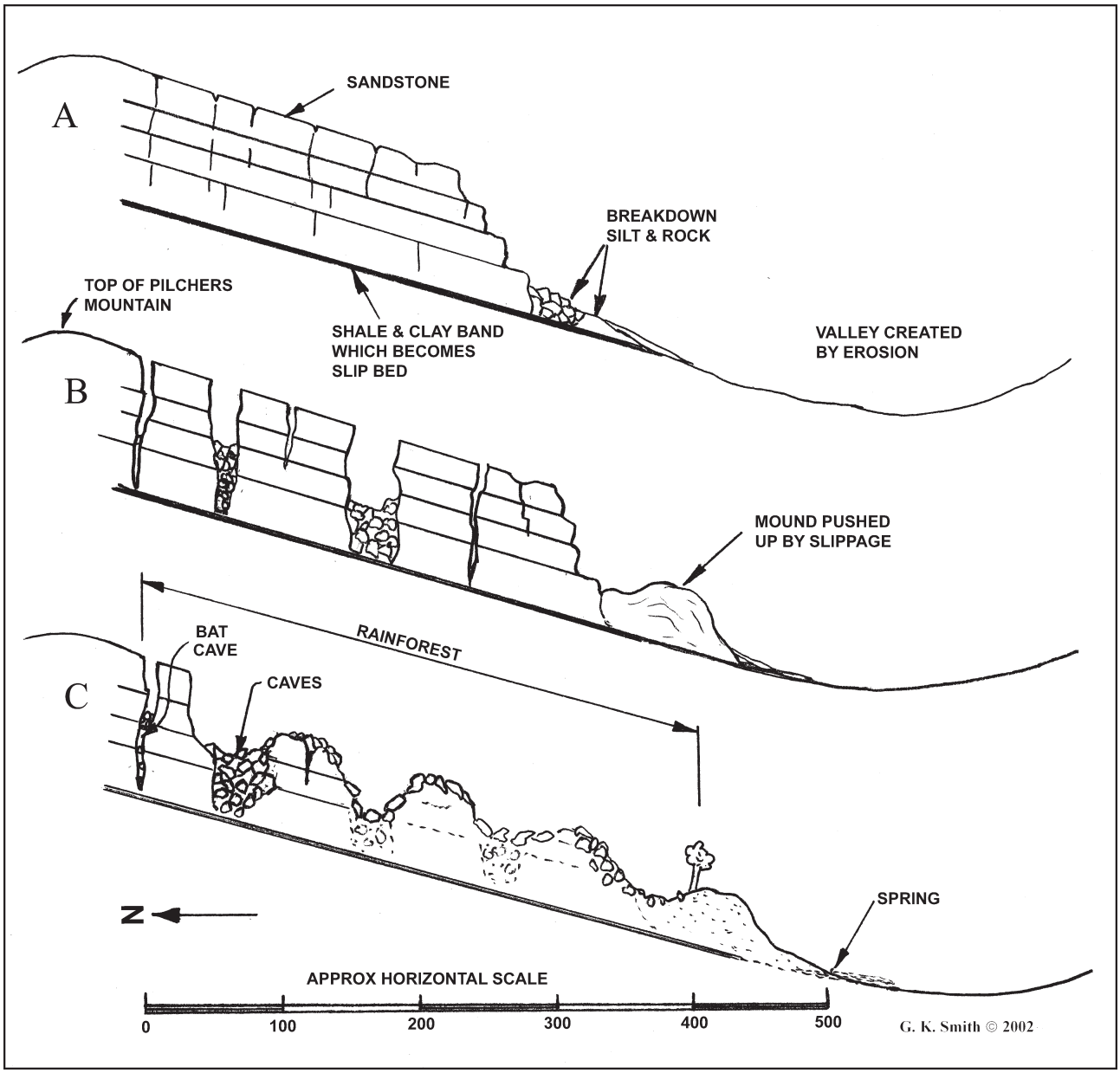


Figure 8: Sequence of movements which formed the chasms and caves at Pilchers Mountain (after England 1982).

The caves most visited are Bat (Main) Cave, Valentine Cave, Lambton Cave and Crawler Cave. Visitors to Rebel Cave should be very wary of loose rocks as this cave can be very dangerous even to the experienced caver. To protect the bats, visitors should not enter Bat Cave in winter during the hibernation period.

Table 1 has a complete listing of known caves.

Origin of the Caves

The chasms formed as a result of massive sandstone block separation along sub-parallel joint planes, aided by the dip of the sandstone layers towards the floor of the valley, and the presence of underlying shale and coal bands which acted as slip planes when lubricated by groundwater (England, 1982). Figure 8 depicts the possible movement which led to the development of the chasms and caves at Pilchers Mountain. Some speculate that the creation of the chasms occurred gradually over millions of years, however Hunter (1991) suggests that the development process may well have been accelerated by the numerous earthquakes which occurred in the district over hundreds or even thousands of years.

There are two main types of caves represented at Pilchers Mountain. Rebel and Bat Cave would typically fit the cave development type described by Springer (2003) as "Tectonic" caves formed by the movement of large blocks of bedrock atop shales, which allow the overlying blocks to literally slide away. Typically there are solid bedrock walls which have matching shapes on the opposing sides of the chasms. Because there are many variations of cave development due to rock movement, Halliday (2004) uses the generic term "Crevice" caves to cover narrow rectilinear crevices of natural origin. Webb et. al (2003) uses the term "Fissure" Caves when referring

New tag No.	Cave Name	Discovery	Mapped
	Main Chasm (Gorge)	Before 1889	Mapped 5-9-75
I6B15	Bat Cave (Main Cave, Wallaringa Cave and Pilchers Cave)	Before January 1970	Mapped by J. Smith, K. Rugg, G. McHugh & W. Brown, 29-8-75.
I6B16	Cleft Cave	Before January 1976	Mapped by Steven Smith, 2-4-77, Grade 4 map
I6B17	Diamond Mine	Before June 1975	Mapped by Peter Payne, David Carey & Wayne Smith, June-1975, Grade 4 map
I6B4 & 5	Rebel Cave	Around 1970	Sketch map 22-2-86 by D. Armitage et.al. Survey & map by Garry K. Smith, Evelyn Taylor & Glenn Stalgis, 14-6-03
I6B6	Spider Hole	Before January 1976	No Map
I6B7	Arch Cave	Before January 1976	No Map
I6B8	Stalactite Cave	Before January 1976	No Map
I6B9	Cathedral Cave	Before January 1976	No Map
I6B10	Crawler Cave	Before January 1976	No Map
I6B11	Valentine Cave	Discovered by members of Valentine Venturer Scout Unit prior to Jan. 1976	No Map
I6B12	Pioneer Cave	Discovered prior to Jan. 1976 – links up to Valentine Cave I6B11	No Map
I6B13	Lambton Cave	Discovered by Garry K. Smith some time prior to January 1976, and named after Lambton Venturer Scout Unit	Mapped 27-2-93 by Garry K. Smith, Michael Smith, Pat Hyde & Katie Mottram
I6B14	Kotara Cave	Discovered by members of Kotara Venturer Scout Unit in 1992	No Map

Table 1: Known Caves at Pilchers Mountain. Compiled from information by Powell, 1976 and Smith, 1995

to caves created by movement of large sandstone blocks in the Sydney area of NSW Australia.

Around the world, many local terminologies are used to describe this type of caves. Examples are: breakaway caves, cambering caves, closed joint caves, crack caves, crevasse caves, crevasses, earth cracks, earthquake cracks, eruptive fissures, fissure caves, gravity sliding caves, gulls, gull caves, joint caves, mass displacement caves, mass movement caves, open joint caves, rift caves, rifting caves, rock topple caves, sliding fracture caves, slope movement caves, tilting caves, toppling caves, and windy pits (Halliday, 2004a)

The second cave type can be classified as "Talus" or rockpile caves, consisting of the voids amongst large breakdown rocks and boulders which have fallen into depressions (Halliday, 2004b). Examples at Pilchers Mountain are the Valentine, Diamond Mine and Lambton Caves.

HISTORY

The chasm area and rainforest certainly would have been known by the aboriginals of the Worimi tribe (Tindale, 1974), who inhabited the area prior to European occupation. However there is no archaeological evidence to suggest that they entered the caves, and no Aboriginal sites are known within the reserve (Hirst, 2004).

Pilchers Mountain was named after Henry Incledon Pilcher who arrived in NSW during 1830 and was admitted to practice as an attorney and solicitor of the Supreme Court. He was granted a large estate called Wallaringa, near the mountain. Pilcher lived in Maitland where he practiced as a solicitor, while the estate was managed by an overseer who utilised a convict workforce (Hunter, 1991).

Around 1840 a group of notorious bushrangers called the 'The Jewboy Gang' terrorised the district, robbing travellers and homesteads of money, guns, ammunition, silverware, jewellery etc. This group of seven escaped

convicts carried out robberies in many parts of the Hunter Valley and even up into the New England district. One of the convicts had escaped from the nearby Wallarobba Estate (within 5km of Pilchers Mountain). This estate, owned by Matthew Chapman, was thoroughly robbed as were many others in the area. It was believed by some that the overseer and convicts of the Wallaringa estate collaborated with the outlaws. One of the gangs' hiding places was known to be in the Wallarobba mountains. Hunter (1991) speculates that the Gang may have stowed their ill-gotten wealth in the boulderous caves at Pilchers Mountain. The gang's reign of terror came to an end on the 23rd December 1840 when they were captured at Doughboy Hollow over the range from Murrurrundi. The seven were taken to Sydney, tried, convicted and hanged in March of 1841 (Smith, 1994).

Certainly the chasms of Pilchers Mountain were known by the early 1880's, as a description dated 1886 refers to a fissure varying in depth from 100 to 300 feet (30 to 90 metres). The account also mentions large boulders and lush vegetation similar to a jungle with a tall tree canopy (Hunter, 1991).

During early European settlement and the clearing of land for grazing, it was inevitable that the early pioneers stumbled upon the chasms and rainforest, possibly even discovering the Bat Cave entrance, but no records have yet surfaced to indicate the exact time of its discovery.

The significance of these unique chasms, rainforest and caves was realised soon after their discovery, hence an area covering about 65 acres (26.3 hectares) was gazetted a Crown Reserve number 8894 on 18th April 1889 (Government Gazette, 1889).

The earliest known map to indicate the existence of caves on the reserve is the NSW Crown Land Administrative Map from County DURHAM, Parish of DUNGOG, Edition 4, dated 3rd June 1879.

The Dungog Shire Council (formerly Wallarooba Shire Council) was appointed as Trustee of the reserve on 18th February 1916. However this appeared to be just formalising the situation because under the local government act, the Council had care and control of the reserve since its gazettal in 1889.

In the late 1960's and early 1970's the first caving groups began exploring the area. The cave now called "Bat Cave" was referred to as Wallaringa Cave (WC1) in 'CAVE' the official newsletter of the Newcastle University Speleological Society, May 1970. In this publication the editor (Jordan, 1970) states *"Wallaringa Cave was run through with compass and tape early last year, but nothing further has arisen from this. The Cave is in sandstone, and has been formed by the collapse of a rock mass. It is the only reported cave of its type in Australia, so mapping it will be worthwhile, as would be a full scale study."* The trip report describes five cavers entering (WC1) and exploring the main level but not the lower level. They then moved on to another previously unexplored hole at the top of the chasm (Jordan, 1970). From the description one could assume that they descended the small pitch into the first chamber of Rebel Cave. The name Wallaringa was taken from the name of the property at the junction of Spring Creek and Coxs Creek as shown on the early 1 inch to the mile maps of 1942. However, on more recent maps the Coxs Creek was renamed Wallarobba Creek. The Wallaringa property is approximately one kilometre south-west of the caves. (Figure 2.)

During the late 1960's members of the Scout Association began visiting the area on a regular basis. Beginning in April 1970, several courses per year were conducted to train adult and youth members in all aspects of caving and abseiling with a strong emphasis in conservation and heritage values. Some courses in the early years involved in excess of 50 participants, however in later years this number reduced to around 10 to 15 per course. Regular courses have continued to be run to the present day.

In January 1988, the National Parks and Wildlife Service (NPWS) proposed to acquire Pilchers Mountain as a Nature Reserve. This led to a meeting on the 5th June 1992, where agreement was made between NPWS, Dungog Council and 'Department of Conservation and Land Management' (CaLM) to dedicate the reserve for Environmental Protection and Recreation following land assessment action. NPWS agreed to withdraw from a Nature Reserve acquisition proposal on completion of a Plan of Management for the site (Wiseman, 1994).

In November 1995, the NSW Department of Land and Water Conservation, released for public inspection a 'Draft Assessment of Crown Land at Pilchers Mountain' as a requirement under the Crown Land Act 1989, to seek public comment prior to changes in Reserve classification (George, 1995).

The Reserve 8894 (Lot 338 DP No. 1009839) covering 30.07 hectares, was dedicated as an Environmental Protection Reserve (Reserve No. 1002990) on 15th December 2000, and the earlier classification of Crown Reserve for Public Recreation was revoked. (Government Gazette, 2000). The Dungog Shire Council was appointed to manage the affairs of the reserve trust (Aquilina, 2000).

In a letter to the Dungog Council, the Manager of Resource Access and Compliance for the Department of Land and Water Conservation, said the change in the reserve's status was "in recognition of the significance of the site." (Garboll, 2001).

During 2003 the Dungog Council applied for and received a Government grant to fund the preparation of a "Plan of Management" for the Pilchers Mountain reserve.

In late 2003 the Council formed the Pilchers Reserve Committee to oversee the development of the 'Plan of Management' (PoM) and aid in the implementations of

any recommendations which arose from the preparation of the Plan. The Committee composed of adjacent landowners, representatives from the community (bushwalkers, birdwatchers, Scout Australia and caving clubs), Department of Environment and Conservation (National Parks and Wildlife Service) Department of Lands, the local Aboriginal Community and Dungog Council. At the same time the consultants GHD Pty Ltd. were contracted to compile the PoM with input from the advisory committee. The first draft of the PoM was presented to the Pilchers Reserve Committee in August 2004 for comment.

The Draft PoM was then placed on public exhibition in March/April 2005 and submissions on the draft were considered by the Pilchers Reserve Committee at a meeting in April. As a result of the public submissions, a significant number of changes were made to the Draft PoM.

At the time of writing in May 2007, the draft PoM had not been finalised, despite numerous meetings, site visits and many months of ongoing discussion between interested groups and stakeholders. It is believed that a final draft PoM is close to being adopted by the committee and presented to Dungog Council for ratification. The document will then be placed on exhibition for public comment, which may result in minor amendments before it is finally implemented.

Visitor numbers remained fairly constant over the last 30 years to the present day. Organised groups comprise the majority of visitations include members from the Scouts Association, local caving club – Newcastle and Hunter Valley Speleological Society Inc, various bushwalking and bird watching groups.

FLORA

The chasms within the reserve contain dense subtropical rainforest with an upper canopy in many places exceeding 50 metres (Figure 7). There are a number of varieties of tall trees, among them giant Morton Bay Fig, *(Ficus macrophylla*) with buttresses exceeding 6 metres. Some of the finest examples in Australia of the Giant Stinging Tree *(Dendrocnide excelsa)* can be found in this rainforest. There are many good specimens of the Strangler Fig *(Ficus watkinsiana)*, which have taken on the shape of their former host tree, before it died and rotted away from within the grasp of the fig. Other examples of the Strangler Figs' determination to survive are where they have actually grown over and around large boulders the size of small houses.

In the rainforest there are other tall trees, include the Flame Tree *(Brachychiton acerifolium)*, Red Cedar *(Toona australis)*, and Brown Beech *(Pennantia cunninghamii)*.

The high canopy trees are hosts to huge vines, ferns, orchids and mosses. Among them are Elkhorn *(Platycerium bifurcatum)*, Staghorn *(Platycerium superbum),* Bird's Nest Fern *(Asplenium australasicum)*, Pink rock orchid *(Dendrobium kingianum)*, King orchid *(Dendrobium speciosum),* and Maidenhair Fern *(Adiantum aethiopicum)*. The vine Smooth Tender Grape (*Cayratia clematidea*) reaches its known southern limit here. These are just a few of the 120 plant species which Floyd, (1982) recorded within the reserve.

At the extremities of the rainforest and on parts of the surrounding land now used for grazing, one can see the occasional Grass Trees *(Xanthorrhoea)*, numerous varieties of Eucalyptus as well as Turpentines *(Syncarpia procera)* and Wattles belonging to the *Acacia* genus.

The chasms which host the dense subtropical rainforest are in stark contrast to the surrounding grassy hills outside the reserve which are cleared of their original dry sclerophyll forest.

FAUNA

The caves contain a variety of vertebrate fauna. The Bat Cave is the roosting site for a large colony of Eastern Bent-wing Bats *(Miniopterus schreibersii)*. The colony usually roosts in a small chamber which is generally inaccessible to humans. A small number of Eastern Horseshoe Bats *(Rhinolophus megaphyllus)* can be found in some caves. Personal observations of bat numbers in the Rebel and Bat Caves over the past 37 years has not identified any discernable change in the bat population as a result of visitation by organised groups.

Invertebrate fauna observed in the caves includes crickets, millipedes and various other unidentified invertebrates. There are also unidentified species of geckos and frogs. The two permanent springs which drain from the reserve, have not been investigated for aquatic fauna.

The subtropical rainforest within the chasms supports a diverse range of wildlife including; Spotted-tailed Quoll (*Dasyurus maculatus*), Brush-tailed Phascogale (*Phascogale tapoatafa*), koalas (*Phascolarctos cinereus*), Long-nosed bandicoot (*Perameles nasuta nasuta*), unidentified possums and wallabies.

Fruit eating birds such as Top-knot Pigeon (*Lopholaimus antarticus*), Wonga Pigeon (*Leucosarcia malanoleuca*), White-head and Brown Pigeons have all been recorded in the area. Other birds include the Regent Bower Bird (*Sericulus chrysocephalus*), Southern Boobook Owl (*Ninox novaeseelandiae*), and Wompoo Fruit–dove (*Ptilinopus magnificus*) (Floyd, 1982). Hirst (2004) lists 60 species of birds within the reserve, including the rare Peregrine Falcon (*Falco peregrinus*)

CONCLUSIONS

The Pilchers Mountain caves and chasms are significant geomorphic features in sandstone, not

previously documented in speleological literature other than brief trip reports.

The chasms, caves and remnant rainforest within the Reserve are important habitats to a variety of flora and fauna. The Reserve remains an important site for study, training and recreation. Regular visits are undertaken by organised groups such as the Newcastle and Hunter Valley Speleological Society Inc, Scout Association, bushwalking and bird watching groups, all of which aspire to high conservation values within their organisation.

The present visitor numbers (estimated at less than 200 per year) has not resulted in any notable degradation of the flora or fauna within the reserve. Comparisons of early photographs has not shown any significant change in vegetation coverage other than a few pockets of introduced weeds (eg. *Lantana camara*).

Due to the remoteness of the reserve and access only via foot the reserve has remained in a pristine natural state. Without the appointment of a fulltime ranger the continued conservation of the area is reliant on support of surrounding property owners to report any illegal activity to the authorities, as they have in the past. These occasional illegal activities (eg. removal of ferns) have been associated with visitation by individuals not affiliated with any conservation minded organisations.

The formalisation and implementation of a PoM to balance the conservation, cultural heritage, public access, recreation and interests of surrounding landowners is essential to ensure continued preservation of these natural wonders into the future. The continued visitation by organised groups in line with presently established practice appears to provide a good balance between public access and sustainable conservation.

The PoM should also include a program to control introduced weeds and feral animals as well as encouraging ongoing research projects to provide defined baseline data and monitoring of future impacts within the reserve environment. Within the caves, research projects could include bat and invertebrate surveys, photographic documentation, cave exploration and mapping.

ACKNOWLEDGEMENTS

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